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The scientific and practical aspects of interdisciplinary research in engineering pedagogy

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Abstract

This article analysis the possibilities of using an interdisciplinary approach and develops content's for professional training of future engineer-teachers in higher education institutions and skilled workers in the system of vocational education. The interdisciplinary approach will be considered from a scientific and practical point of view. Characteristic designs based on an interdisciplinary approach describes activities of an engineer-teacher, the opportunities, potential and their design competencies.

Zusammenfassung

In diesem Artikel werden die Möglichkeiten eines interdisziplinären Ansatzes erörtert und Inhalte für die berufliche Ausbildung von angehenden Ingenieurlehrern an Hochschulen und Fachkräften im Berufsbildungssystem erstellt. Der interdisziplinäre Ansatz wird aus wissenschaftlicher und praktischer Sicht betrachtet. Interdisziplinär angelegte charakteristische Entwürfe beschreiben die Aktivitäten eines Ingenieur-Lehrers, die Möglichkeiten, Potenziale und deren gestalterische Kompetenzen.

Keywords:

Interdisciplinary
Interdisciplinary approach
Design activities
Design competence
Professional education
Engineer-teacher
Technical-teacher

Schlüsselwörter:

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1 Initial situation of the problem

The purpose of the article is to study a multidisciplinary approach to the content of vocational education and formation of professional competence (e.g., Engineering Design) at the future of vocational education teachers (teachers of technical subjects).

Integration processes in science, technics, production, scientific and technological progress let develop and emerge new information technologies which affects modern industry and change the interaction of people in the production process. Modern production needs specialists whose education and development level corresponds to the state of science, engineering and technology. They have to be able to interconnect science and production and integrate it into production processes.

A high quality of the educational process in vocational education institutions is necessary to create specialists for future professional activities and modern requirements. Therefore, the issues of training future vocational education teachers who will carry out their activities in vocational education institutions are relevant.

A vocational education teacher is a specialist with engineering and pedagogical education associated with a particular industry and with the vocational education system. An educational engineer is a multifunctional specialist. He must carrying out both, theoretical and industrial training, prepare and teach technical disciplines and be able to determine new academic subjects and develop a method for teaching it [1].

The problems that an engineer-teacher has to solve in the process of professional pedagogical activity are complex interdisciplinary, arising on the border of pedagogical and other sciences. Therefore, the system of technical and pedagogical knowledge of an engineer-teacher should integrate fundamental and generalize knowledge both of the technical-production and psychological-pedagogical plan. Most of them are elementary and encompass the process of both theoretical and practical training of the profession.

2 Analysis of studies and publications

To determine how to apply an interdisciplinary approach to the content of professional education and the formation of professional competence among future teachers of technical disciplines, it is necessary to analyze the scientific and practical aspects of this problem.

For the professional training of future specialists in any field, it takes a certain organisation of the educational process which allows them to form the necessary professionally significant qualities under modern requirements. The key role of the basis of pedagogical theory is a scientific concept, thus determining the quality of pedagogical practice.

Pedagogical education of the 21st century characterizes the trends in achieving international standards, the continuity of education throughout life, the transition from single subject to interdisciplinary training based on a competent approach which ensures the flexibility of a future specialist and his competitiveness in the labor market. These and other issues are covered in the Laws of Ukraine "On Education", "On Higher Education", the State National Program "Education" (Ukraine of the XXI centuries), reflects in the basic principles of the development of higher education in Ukraine and in the Bologna process [2].

In Paris, 1998 a communiqué of the UNESCO conference “New Dynamics of Higher Education and Science for Social Change and Development” states that, educational systems in higher education should become more flexible to promote science and interdisciplinarity. Therefore, the priority nowadays should be assigned to the ideas of an interdisciplinary and conceptional approach to improve the pedagogical training of future specialists.

Methods of implementation and the scientific provisions of an interdisciplinary approach to the pedagogical training of future specialists are highlights in the studies of S. Goncharenko, L. Kamenskaya, V. Kremen, V. Ognevyuk, S. Sysoeva, V. Stepin, L. Yakovenko and others, who are convinced that changes in the paradigms of education, introducing innovations, in particular modern methods, means and forms of teaching in teacher training can achieve through by the interaction of various sciences and interdisciplinarity.

An analysis of the scientific literature showed a significant interest of researchers in the phenomenon of interdisciplinarity in the educational process. A great contribution to the substantiation of this concept made Ukrainian and foreign scientists who consider the concept of interdisciplinarity from different perspectives [3][4]:

- interdisciplinarity is interpenetration, mutual enrichment of approaches and methods of various scientific disciplines;

- interdisciplinarity is the ability to discover, recognize, accept what it hid in the bowls of a single science using methods and tools of other sciences;
- interdisciplinarity is the borrowing by the interconnected sciences of methods, tools, research results, the use of their theoretical schemes, models, categories, concepts;
- interdisciplinarity is not only the borrowing of methods, tools of various sciences but also the integration of the latter in the sense of constructing interdisciplinary objects, the processing which allows you to get new scientific knowledge;
- interdisciplinarity is a scientific and pedagogical innovation, it gives rise to the ability to see, recognize, accept what is not available within a single science with its specific, narrowly oriented object, subject and research methods;
- interdisciplinarity in its broad, functional understanding - is the synergy of various sciences; provides for the development of integration processes, the interaction of methods, tools for getting new scientific knowledge.

"The interdisciplinary approach solves the contradictions existing in the subject system of education between disparate assimilation of knowledge and the need for their synthesis, holistic and complex application in human activity and life" [5].

The knowledge and skills gained based on interdisciplinary integration enables emergence of the professional competence of an engineer-teacher and determine his willingness to design all the components of the educational process. Therefore, interdisciplinary integration should reflect the organisation of the educational process in the training of engineer-educators in institutions of higher education.

3 Main Statement

The scientific aspects of applying the interdisciplinary approach dictated by modern requirements for specialists in a particular industry, the quality of their training in educational institutions, the modern development of education and science, the degree to which applying an interdisciplinary approach to the formation of the content of professional training in scientific and pedagogical research has been developed (as discussed above).

Practical aspects dedicate the real state of the organisation and implementing the educational process in vocational education institutions, the requirements for it and the level of training of skilled workers.

They carry organisation and implementation of the educational process in vocational education institutions out by pedagogical workers, whose training takes place in special institutions of higher education (in particular, the Ukrainian Engineering and Pedagogical Academy). The activities performed by teachers and their content, taking into account the real state of professional education, should reflect in the training of future teachers of technical disciplines in higher education institutions.

According to the educational and qualification characteristics, the tasks and responsibilities of the teacher of technical disciplines are:

- implementing training and education of students, taking into account the specifics of the academic discipline;
- training sessions;
- responsibility for comprehensive methodological support;
- development of educational plans and programs;
- professional and pedagogical qualifications;
- Study and application in practice of the achievements of pedagogy and information technology.

Analysing the activities of teachers of technical disciplines with a view to its implementation based on interdisciplinarity.

The organisation of the educational process in the establishment of vocational training begins with the development of training plans and programs. Education standards, developed for vocational education based on competence approach of the VET (vocational education teachers). The standard defines a list of general, vocational and key competences, which the future skilled worker must master in a certain profession. They are the basis for the formation of the model curriculum that contains the training (general professional, occupational and vocational theoretical and practical), general unit and training modules.

The general professional unit contains educational material in the disciplines of professional, theoretical, and practical training; it allows students to form elementary general knowledge of the profession and the ability to perform elementary tasks [6].

The training module is a logically completed component of the VET, which contains educational material in the disciplines of professional-theoretical and professional-practical training, necessary to achieve professional competencies, a certain level of qualification. To master a training module means to master a profession of a certain level of qualification [7].

The structure of the training module comprises several competencies sufficient to master a certain skill level. Each competency contains a list of relevant knowledge and skills that you need to master. The formation of these knowledges and skills occurs in studying certain disciplines.

The formation of competency occurs through integrating knowledge and skills in various academic disciplines, which shows the possibility of applying an interdisciplinary approach to the formation of the content of vocational education, a specific training module.

The development of educational and program documentation in vocational education institutions involves teachers. In the organisation's case of the educational process based on VET, this work consists in forming a list of disciplines, designing their content and organic combination based on interdisciplinarity in mastering each specific module, the formation of specific professional competencies.

After determining the list of such disciplines, the time for their study and designing their content (i.e. working training programs), it is possible to develop a working curriculum for training skilled workers in a certain profession and qualification level and to design training sessions.

During designing training sessions, means, creating didactic lesson projects, they should bear in mind that a particular discipline should ensure the formation of knowledge and skills within the framework of various competencies. It is necessary to connect relations interdisciplinary with other existing disciplines to create, transform and implement specific contents of knowledge and competency skills. Moreover it should consider existing interdisciplinary relations in developing an appropriate didactic project.

In order for the teacher to carry out design activities, he must have formed design competence. Many scientists are engaged in the study of design competence; There are many definitions of this concept. For our research, we chose: design competence - a blended result of the educational training of a combined result of the educational training of a future engineer-teacher, reflects the formation of relevant knowledge, skills, professionally important qualities and consists in the ability to carry out design activities in pedagogy and a specific industry by developing the pedagogical and production projects [8].

Given the existing definitions of the concept of “design competence” and the above, it can conclude that design competence (according to most authors) is an integrated result of the educational training of the future engineer-teacher and lies in his readiness and ability to carry out the design of the educational process.

The characteristic of design activity is shown in Fig. 1.

The formation of any competence of a future engineer-teacher is set of educational disciplines (educational components). In this case, the concept of a “complex of educational disciplines” means an interdisciplinary training or an interdisciplinary approach to training, which will ultimately provide an integrated result of the educational training of a future engineer-teacher.

The integrated result of the educational training of the future engineer-teacher is ensured thanks to the educational components, among which we can distinguish those that are responsible for the pedagogical component, and for the engineering one.

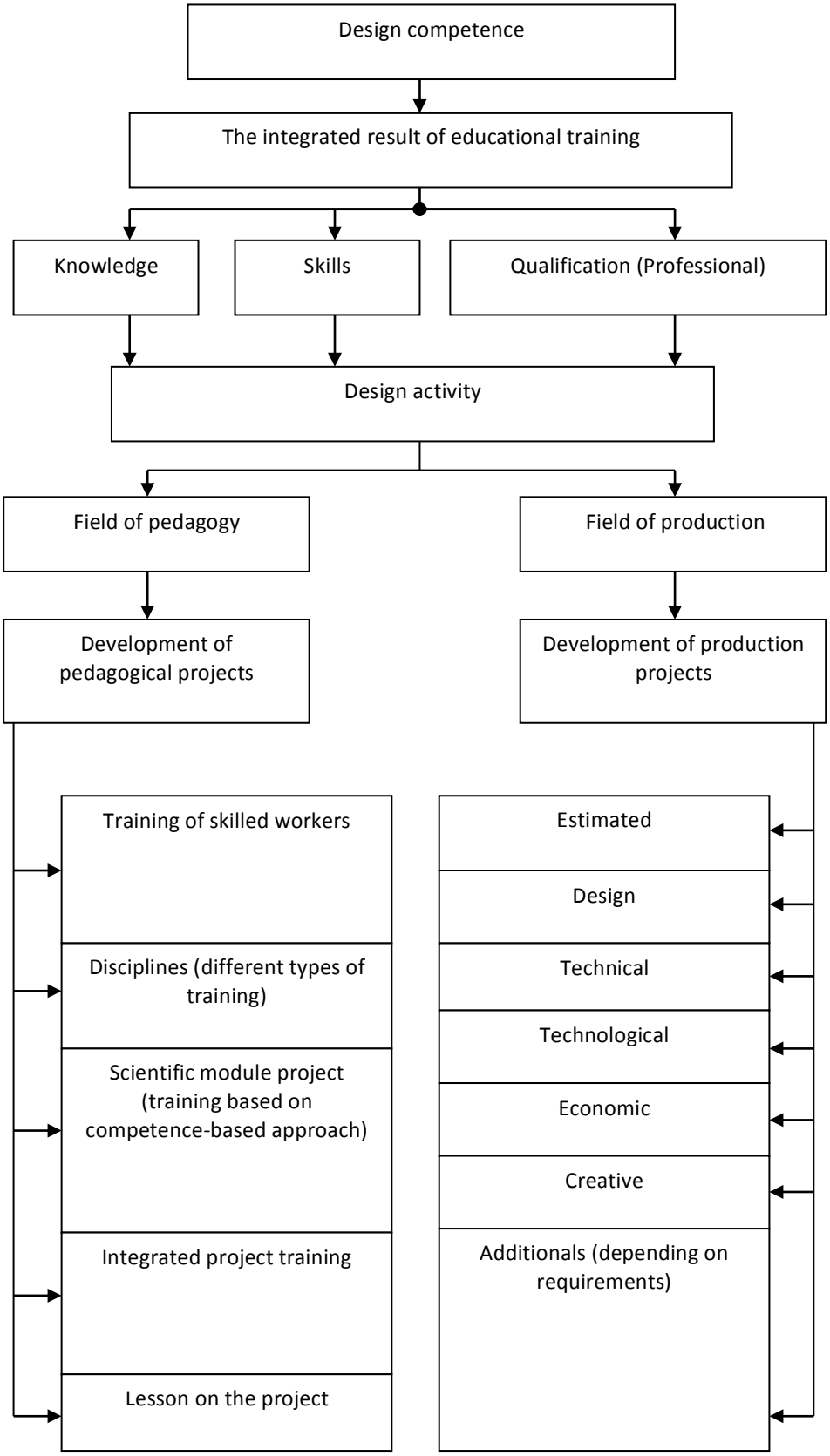

Fig. 1. Characteristics of the design activity of the engineer-teacher

Professional training of future engineer-educators involves the study of various disciplines, interconnected by a sequence of studies that provide the assimilation of other subjects and are the starting point for further professional activity. Each discipline represents a certain science, providing a part of knowledge in the form of objects, phenomena, principles, approaches used in implementing design teaching activities [9].

The problems that the engineer-teacher (teacher of technical disciplines) have to solve in designing pedagogical activity are complex interdisciplinary that arise at the border of pedagogical and other sciences.

Studying engineering disciplines, technical and psychological-pedagogical training is the basis for the formation of professional competence and design details, carried out based on an interdisciplinary approach in solving professionally orientated goals.

4 Summary

The information presented in the article makes it possible to conclude that there are multidisciplinary foundations both in the formation of the content of vocational education in the preparation of skilled workers in the vocational education system, and in the training of future educational engineers in the higher education system. The formation of professional competencies of the future engineer-teacher on the basis of an interdisciplinary approach will allow him to carry out professional pedagogical activities in a sufficiently qualified manner. A separate design competence formed on the basis of an interdisciplinary approach will allow the engineer-teacher to carry out design activities, both in the field of pedagogy and professional training.

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